{HOMEGROWN}

A RESIDENTIAL GUIDE TO EDIBILITY

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I.
ABSTRACT

The following comprehensive project examines the potential for urban residences to become self-sustaining and productive environments using a ¼ acre lot in Muncie, Indiana as an example. It explores how society today has grown further and further from nature, creating a gap that has resulted in the under utilization of the environment. Through this project and research I hope to reconnect humans to nature while creating more sustainable environments to live in, benefiting nature as well as the health, wealth, and happiness of people and their communities.

II.
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III.
TABLE OF CONTENTS

SECTION 1
{FOOD, PEOPLE, AND NATURE}

1.1
INTRODUCTION AND PROJECT BACKGROUND

Forty million acres, 2% of the United State's landmass, is covered in lawn (Hayden). This means that 2% of the United States is under utilized, blanketed by a monoculture of turf, lacking in plant and animal diversity. It has very little usage beyond providing a green carpet on which to lay or recreate, and requires tedious amounts of maintenance. Each week 270 billion gallons of water are used on lawns- enough to sustain 81 million acres of organic vegetables (Goodman). So why keep something useless around? Why not convert these lawns into something that benefits the environment, people, and other organisms that inhabit it? This is when the concepts of permaculture, forest gardening, and paradise gardening can help. These concepts convert useless lawns into balanced ecological systems that mimic the natural cycles of nature to provide food, shelter, and protection to a variety of organisms as well as humans. They empower people to become self-sufficient by enabling them to produce their own food and control what they are eating.

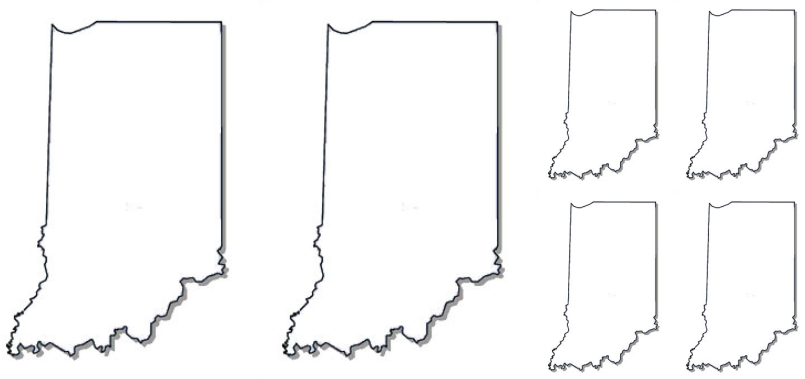


FIG. 1.0: The total area of lawn in the US adds up to equal two states of Indiana. It uses 270 billion gallons of water each week, the same amount needed to sustain an area twice that size of organic vegetables (Goodman).
{Image: www.childinjurylawyerblog.com}

This second idea, allowing people to control what they eat, it very important. In today's society the food that we buy from the supermarket is so far removed from nature that often it looks nothing like the original product. Cucumbers are individually vacuum-sealed in cellophane and products like fruits and vegetables are often imported from other countries, their origin unknown to the consumer. It has gotten so bad that the average American meal travels 1500 miles before it is consumed ("How Far Does Your Food Travel"). This results in unnecessary transportation of goods and unnecessary packaging which all adds up to more waste in landfills and more fuel emissions into the already polluted atmosphere. With the concept of homegrown food this greatly reduces, if not eliminates, travel between you and your food. Not only does food have to travel to your local grocer, you no longer have to make as many trips to the store because you are your own grocer, producing your own food just outside your own door. Homegrown food also reduces packaging. No longer will plastic baggies and single use plastic containers be discarded, rather the food goes from the garden to the plate. And when food goes from the garden to the plate people know exactly what they are getting.

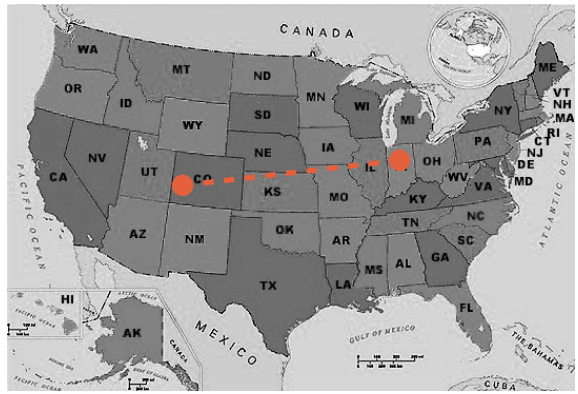


FIG. 1.1: An average american meal travels 1,500 miles before being eaten, the distance between Muncie, Indiana and Telluride, Colorado ("How Far Does Your Food Travel"). {Image: www.emapstore.com}

Homegrown food is not only a way to help the environment, but it is also a way to help people. It is not just a way of gardening, but a philosophy and way of

FIG. 1.2: A photograph of a woman in Arizona tending to her front garden. A multitude of plants occupy the space that is usually only grass. A good example of getting the most from a lawn. {Image: phoenixpermaculture.ning.com}

life that reconnects people to nature by empowering them with food. When people take the responsibility of growing food into their own hands they become part of a larger system, one that feeds and nurtures its inhabitants. Homegrown food reduces waste and increases the diversity and the overall wellness of the environment and the people around it creating stronger people and places.

Growing food at home is possible for anyone, no matter how large their home or lawn. By taking the space they have and converting it into a more balanced ecosystem it will produce nourishment for them and the environment. Converting lawns into urban gardens can be both functional and aesthetically pleasing, even more so than a turf lawn. The design principles of permaculture, forest gardening, and paradise gardening can be used to do this. An individual home is part of a larger community and can become a catalyst for the whole community to become a more balanced and connected environment. This can be done with local markets held in public areas such as a school or library. Every week a local market could be held where people can sell the food they grow and share the knowledge they have gained by converting their lawns into urban gardens. This way a community is united and renewed through food.

1.2
THE IMPORTANCE OF FOOD

Food is a necessity of all living things. It is a transfer of energy from one trophic level to another, a recycling of nutrients, an interaction done by every species. But for humans it can be much more than that. Food is a center of our lives and of our cultures. It shapes the structure of our days dividing it up into breakfasts, lunches, and dinners. It is also the highlight of special events. What celebration does not consist of a meal? Food brings people and community together and feeds the body and soul. It is a need and a want. In fact, it is so important that every aspect of food shapes every aspect of our lives. How food is grown, collected, stored, distributed, and disposed of are all steps that influence how people live. It is something that we need so badly that it has even spurred the invention of numerous technologies. Carts, wagons, and boats were all in their infancy made to aid in the transportation and trade of food (Pinderhughes 186). Simple tools, mills, and plows were invented for food as well. Food is so influential that it even affects the way of life for the people who eat and produce it. If food is economical and sustainable than the lives of the people who eat it will be more economical and sustainable. This translates into the fact that food has the ability to influence people's lives, meaning that if people take control of what they are eating they are also taking control of how they are living. This is empowerment through food.

1.3
FOOD AS A RE-CONNECTION TO NATURE

Food is a direct connection between humans and nature. “Eating more than any other human activity, binds us to the world of nature; the vital bridge that connects human culture with the larger environment” (Teitel ix). We need food in order to survive and the environment produces it for us. There is no escape from this relationship with nature, or rather, from this dependency. Ian McCallum (2008) states in his book Ecological Intelligence that the Earth does not need us and does not need us to save it. In fact, it is the reverse. Humans are the ones who need help and the only way to get it is to reconnect with nature (McCallum 2). We can do this by incorporating homegrown food into our diets and into our landscapes. When we do this we are including the cycles of nature into our lives and staying in tune with our environment. Once again, the weather and the passing seasons are a part of our every day thoughts as we relate these phenomena to our food and our food to us. When people begin to realize that these natural happenings affect them directly they will begin to care about what is happening to the environment. They will realize that nature is the source of everything we need to live and if we do not take care of it, all of our resources will become depleted.

“Eating more than any other human activity, binds us to the world of nature; the vital bridge that connects human culture with the larger environment” (Teitel ix).

But just growing vegetables in pots and planting trees is not enough to reconnect to nature. We must do more. We must realize that the earth has natural

cycles, interactions, and dependencies that we must follow and incorporate into our designs. “We must strive to function as ecosystems do” (Beatley 87) to become more balanced and sustainable. Incorporating natural systems and cycles into homegrown food can be done by utilizing three different design principles: permaculture, forest gardening, and paradise gardening.

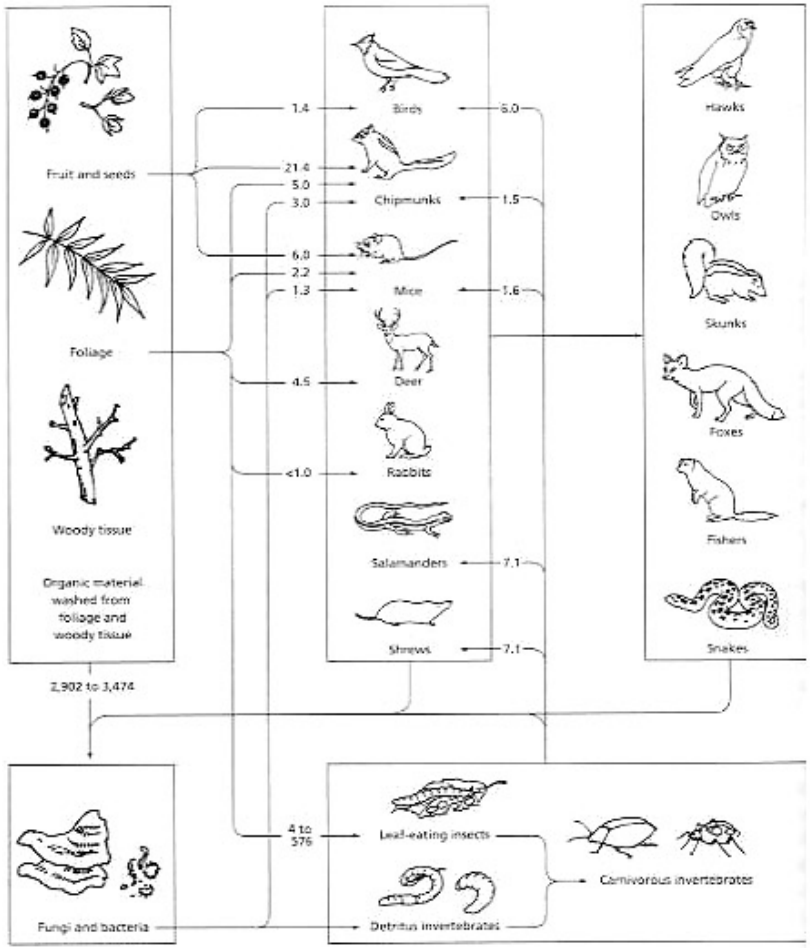


FIG. 1.3: This image was taken from the book: *Edible Forest Gardens: Ecological Vision Theory for Temperate Climate Permaculture Vol. 1 Vision and Theory*. It shows a typical flow of energy between different tropic levels within a hardwood ecosystem. As displayed in the diagram nature consists of cycles, interactions, and dependencies. To become productive, healthy, and alive, yards must mimic these natural relationships. This will form balanced ecosytems that will connect people back to nature. {Image: *Edible Forest Gardens: Ecological Vision Theory for Temperate Climate Permaculture Vol. 1 Vision and Theory*}

1.4
DESIGN PRINCIPLES

In the book Food Not Lawns Flores (18) quotes Ernst Bloch describing permaculture as "conscience design and maintenance of agriculturally productive ecosystems which have the diversity, stability, and resilience of natural ecosystems." In essence, permaculture is growing food by mimicking nature to produce a successful garden that takes into account the needs of not only the crops, but of every part of an ecosystem. According to McDonough (8), "What prevents living systems from running down and veering into chaos is a miraculously intricate and symbiotic relationship between millions of organisms, no two of which are alike." In an ecosystem everything is dependent on one another. Plants need insects to pollinate them so that they can produce food and insects need the food that the

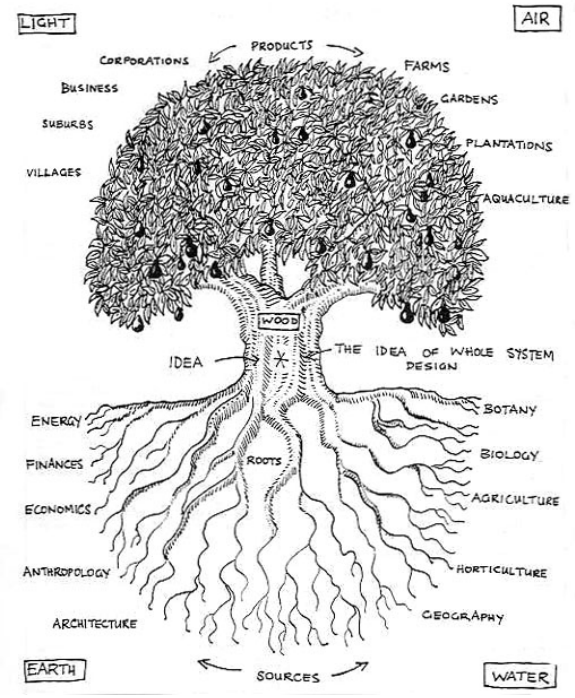


FIG. 1.4: A sketch of the Permaculture Tree shows how the principles in permaculture are the foundation and that they radiate into multiple fields of knowledge. It also shows how these sources produce many different things, all in balance with one another. {Image: *Introduction to Permaculture*}

plants produce. If humans want to be successful at producing their own food they must realize that they too must become part of the intricate ecosystems that they so often ignore. When we as a species step into the cycle we begin to work with our counterparts instead of against them, resulting in less work and a more plentiful harvest. “When we work with nature, rather than against it, everything gets easier, more delicious, and potentially more sustainable” (Flores 17).

The second design principle studied is called forest gardening. Much like permaculture it recognizes the benefit of ecological design but it focuses on perennial plants, shrubs, and trees to produce goods. According to Jacke (1) forest gardening is a “perennial polyculture of multipurpose plants … it is an edible ecosystem, a consciously designed community of beneficial plants and animals intended for human food production.” Forest gardens embrace the concept of ecosystems that evolve and grow throughout time providing food and shelter for humans and other organisms. It is a concept of going beyond the garden and returning to the hunter and gatherer mentality and realizing that “there is incredible generosity in the potentialities of

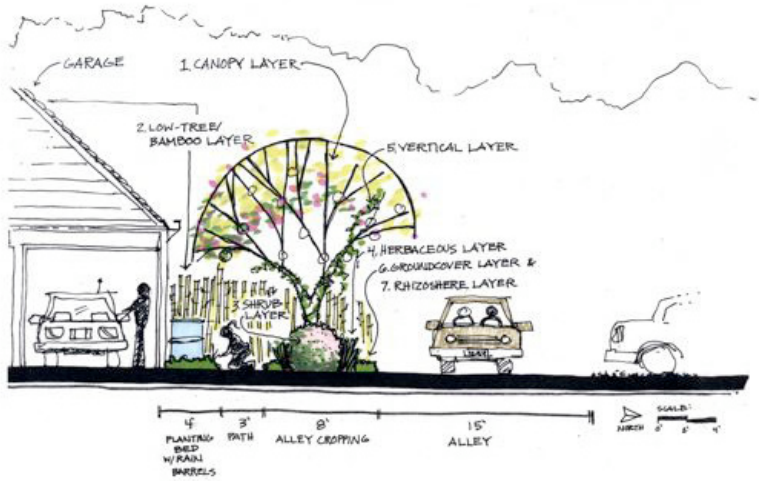


FIG. 1.5: One of the main principles in forest gardening is the seven forest layers. This concept mimics nature by utilizing all the space available to produce food and fiber, not only for humans, but for other species too. {Drawing: Vanessa Gilbert}

Nature" (Hart 58). Forest gardening is the idea that a garden should provide more than just resources to humans and instead be "a living ecosystem: sheltering and feeding wild creatures, conserving water and nutrients, and modifying climate on both the local and planetary level" (Hart 1).

The last design principle is paradise gardening. Paradise gardening was coined by Joe Hollis who describes it as "a way to live on earth that promotes our health and happiness… not using more than our share, and harmonious with the biosphere's evident drive toward increasing diversity, complexity, stability." It is not only a guide to design but also a guide to living. It is "rejecting the consumer culture and instead embracing an outdoor life that is rich in organic foods, personal interactions, and intentional learning" (Flores 15). Paradise gardening is taking care of the earth and allowing the earth to take care of us by collecting the bounty that it grows. It is a close-knit relationship between human and nature where humans return to the niche within the ecosystem to live in simplicity. Paradise has always been described as a perfect state of nature that is lush with life and bursting with food. This is exactly what nature already is. The reason that people do not realize this is because they have spent too much time fighting against nature in order to gain control over it. Paradise gardening is working with the natural systems that surround us to feed the earth and ourselves.

1.5
THE INFLUENCE OF FOOD ON HEALTHY LIFESTYLES

As mentioned before, food is a very important component of our lives. It affects the physical health of each individual and also the health of a community as a whole. First, homegrown food provides a source of fresh produce. But this food is more than just "fresh," it is natural and clean. Much of the food found in supermarkets today is genetically modified. While these organisms produce higher yields and more successful crops they result in less nutritious food and damaged ecosystems caused by the monoculture that they are grown in and the fertilizer and pesticides used to grow them. Food grown in this way stomps out nature to make room for itself and reduces the quality of our environment. By growing ones own food we delete these negative impacts on the environment and produce something that is healthier for humans as well. The food is picked at its peak ripeness instead of weeks before. Food is also "in season" instead of being forced to grow when it naturally does not. This produces a more nutritious crop.

"Growing and harvesting food that is nutritious and "alive" not only provides us with more energy, but contributes to an overall sense of well-being and self-reliance that nourishes the spirit as well as the body." (Hart 16).

Food also helps the mental and spiritual health of people. According to Hart (16) "growing and harvesting food that is nutritious and "alive" not only provides us with more energy, but contributes to an overall sense of well-being and self-reliance that nourishes the spirit as well as the body." When someone is engaged in an activity

that brings him or her joy it reduces stress and makes them a part of something bigger. It gives them something to care about and stimulates the brain to think and problem solve. These all result in a healthier happier person.

Food helps grow better communities as well. When our own food is grown "we regain control of the quality and availability of our food supply, which results in healthier more confident people. Next when we share the harvest, our neighbors become more like friends" (Flores 14). This re-connection through food is only natural. When we begin to grow our food we reconnect ourselves to nature and begin to reestablish the relationships and dependencies that naturally occur within ecosystems. These relationships begin to form and grow among the people as they realize that helping each other benefits everyone and in turn these "relationships build social structure" (Jacke 121).

1.6
FOOD FROM AN ECONOMIC STANDPOINT

Trillions of dollars go into the food industry every year but how much actually goes towards the actual growing of food? Much of the money is spent on transportation, packaging, and storage; none of which benefit humans or the environment. Instead, it increases food prices and pollutes the earth with unnecessary waste. Pinderhughes (190) states, "A significant number of energy resources are dedicated to transporting food from farms, to and from processing and packaging centers, food outlets and markets, and households." This puts money in the pockets of unneeded middlemen and takes money from the people who really need it. It also uses energy that is unnecessary. When food is locally grown it reduces the cost of transportation and

FIG. 1.6 and 1.7: (left) A semi truck travels down the highway, a very common sight to see and how most food gets from where it is grown to where it is eaten. (right) A small red wagon, all you need to transport produce from the yard to the table. {Images: www.allstartrading.com, inchbyinchrowbyrow.files.wordpress.com}

“When food is locally grown it reduces the cost of transportation and increases local jobs. This helps create a foothold for local economies and forms a symbiotic relationship between members of the community.”

increases local jobs. This helps create a foothold for local economies and forms a symbiotic relationship between members of the community. People begin to rely on local growers for their food and local growers rely on the community to make a living. It is a way of “local self-sufficiency” and spurs development in dying cities. According to Beatley (147) “ the most effective strategies for sustainable economic development revolve around ongoing investment in local labor, products, and services, including the consumption of locally grown produce and agricultural products.”

1.7
APPLYING FOOD TO URBAN ECOLOGY AND THE URBAN LANDSCAPE (PRECEDENCE)

The principles of homegrown food create an urban ecosystem where each part of the system is reliant on the other for survival. It is a re-connection to nature through food that uses design to restore the natural order of living systems. It is an answer " to the colossal harm that our present industrial system is causing to the global environment…" by using "a sustainable system, geared largely to the non-polluting, life-enhancing products of the living world" (Hart 1). Through growing and consuming food we begin to shape communities and lifestyles that are better for our health, the environment, and the economy.

A good example of applying food to the urban landscape is the Dervaes' residence in southern Pasadena, California. This family converted their tenth of an acre lot into a 300 species garden that produced approximately 3 tons of food a year. Their main technique of producing such a productive area was layering and taking advantage of vertical space.

FIG 1.8: Spread in the magazine *Natural Home and Garden* featuring the Dervaes' residence.{Photos: Stephen Dasrowski, *Natural Home and Garden,* }

SECTION 2
{THE PROBLEM AND ITS SETTING}

2.1
THE PROBLEM AND SUB-PROBLEMS

Society has been moving away from the environment, creating a gap between humans and nature. This void has removed society from a world that it is dearly dependent on. This is causing misuse and abuse of the environment. In order for the human population to continue to exist we must begin to take better care of the earth so that it can continue to provide us with the resources that we need to survive. To do this we must:

1. Reconnect with nature and reincorporate our lifestyles to fit into the ecosystems
 we live in.
2. Utilize the land that exists by redesigning it to be a balanced ecosystem that mimics nature.
3. Reconnect to each other.

We must also ask the following sub-problems:

1. What is the importance of food to society?
2. How does food serve as a re-connection between nature and humans?
3. How much food do people need?
4. What does a balanced ecosystem need?
5. What are influential design principles in the area of homegrown food?
6. How does homegrown food shape urban ecology and urban design?
7. How can homegrown food affect the larger community

2.2
PROJECT SUMMARY

This project is the redesign of the existing ¼ acre residence of 1006 Wayne Street in Muncie, Indiana into an example of a self-sustaining, food producing landscape using the principles of permaculture, forest gardening, and paradise gardening. This has been done at three different levels to provide examples of edibility at three different intensities. The final goal is to produce on site half the amount of food an average family of four consumes in a year.

This goal was met by using vegetables, perennials, vines, shrubs, and trees to create a balanced, productive, and aesthetically pleasing environment; analyzing plant interactions and how these relationships can result in better yields; the use of chickens and fish in urban environments; and utilizing vertical space.

FIG 2.0: Existing front view of 1006 Wayne, Street Muncie, Indiana. {Photos: Vanessa Gilbert}

2.3
SITE SUMMARY AND DESCRIPTION

The site for this project is a two-story residence located at 1006 Wayne Street in Muncie, Indiana. It is two blocks away from Ball State University and is situated in a neighborhood comprised mostly of college students and middle class residents. The home is approximately 2,385 square feet sitting on a quarter acre lot. It has a concrete driveway, a small grass lawn in the front approximately 5,000 square feet in size, a large sugar maple to the southeast, and a pear to the west. It is privately owned.

This site was chosen because it represents a typical home found in the mid-west. It is neither large nor small and has limited space, making it an ideal example of how ample lawn space is not a prerequisite to a successful, self-sustaining, ecologically balanced home. The original house structure was kept and the principles of permaculture, forest gardening, and paradise gardening were used to transform the residence from a monoculture of grass into a balanced ecosystem that provides food and beauty for its residents. Design and ecological thought was used to choose plants that are suitable for the intent and location. As a result, a small-under utilized space was turned it into a rich fruitful paradise.

2.4
DELIMITATIONS AND ASSUMPTIONS

This study will not address the following:

1. Community gardens, its focus is on the individual scale in urban residential settings and how one person or home can be the start of something bigger. I think that only after each individual understands their own relationship to the environment can they help form something bigger.
2. Zoning requirements, as these are different for each city or location and because they are not permanent. If we are to make a change in the way that we treat the environment and ourselves we must address legislation that is keeping us from moving forward.
3. Climate zones beyond that of Muncie, IN because otherwise the scope of this project would be too big.

This project serves as a how-to guide to convert urban outdoor spaces into ecological systems that produce food by mimicking natural systems.

It also assumes:

1. No local codes ban the growing of food on private urban properties.
2. Weather conditions will sustain a variety of plants.
3. It will take 2-5 years before an edible ecosystem will become fully established.

SECTION 3
{PRELIMINARY DESIGN}

3.1
SITE INVENTORY

Location: 1006 Wayne Street Muncie, IN 47303
Size: ¼ acre lot, 122’ x 80’
Latitude: 40° 11’ 36” N
Hardiness Zone: Zone 6 (0° to -10°)
Soil Type: UemB-Fox fine loamy soil over sand
Slope: 6.5% in front lawn
Annual Rainfall: 40”
Average Rainfall Event: 2”
Annual Rainwater Collection from Roof: 56,700 gal
Area Needed for 1 Chicken: 2-3 sq ft inside coop, 4-5 sq ft outside
Area needed to Raise Tilapia: 2-3 fish/sq meter
Amount of Food consumed by the Average American/ Year: 1,800 lbs (5 lbs/day)
Amount of food consumed by the average American family of four/Year: 7,200 lbs
Site Totals

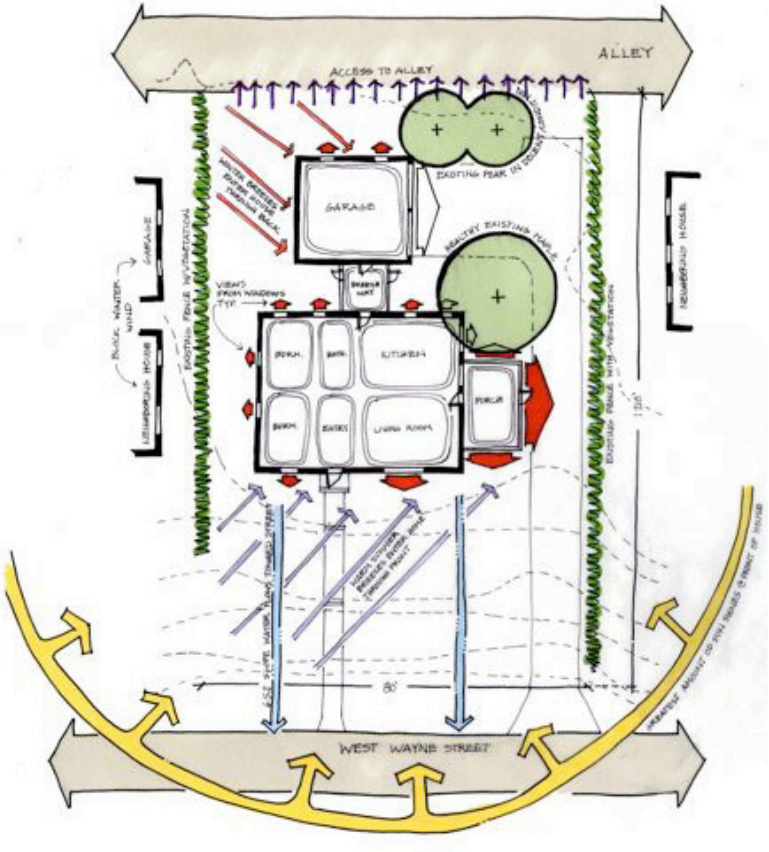
- Building: 2,385 sq ft
- Lawn: 5,224 sq ft
- Bed Area: 1,303 sq ft
- Hardscape: 2,075 sq ft

FIG 3.0: Existing plan of 1006 Wayne Street Muncie, Indiana. Most of the yard is grass and driveway with minimal planting beds and a few mature trees. The existing house is in good shape as well as the sugar maple tree which is located in the northeast quatrant of the lot, these elements will serve as the base for all three designs. {Drawing: Vanessa Gilbert}

3.0 EXISTING PLAN OF 1006 WAYNE STREET

3.2
SITE ANALYSIS

The first step in design is to understand and maximize the site's existing conditions. The following are elements on the site and how they affect the design.



3.1 EXISTING CONDITIONS DIAGRAM

FIG 3.1: This diagram shows the analysis of the existing conditions of 1006 Wayne Street. Optimal sun angles are shown with the yellow. The blue lines show how the water flows down the front slope into the street. The green indicates trees and hedges. The orange arrows are views from windows. Winter and summer wind are shown coming in from the northwest and southwest. Possible access to alley is shown as well. {Drawing: Vanessa Gilbert}

Micro climate (sun, wind, and temperature)

A site's micro climate is a very important element of design. The combination of shade, sun, wind, and temperature creates micro climates that heavily affect the success of the plants placed there. In order to maximize the capabilities of a site these micro climates must be understood. Below, an analysis for each side of the site has been listed, as well as helpful tips for these exposures that apply to most sites in the Northern hemisphere.

- ***North***- In most cases the northern part of a site is mostly shaded. Because of this it is usually the last area to defrost in the spring and the first to frost in the fall. This can be an ideal location for some fruit trees because the delay in warmer temperatures can save spring buds from being damaged by late frosts (Otto 34). To take advantage of this, fruit trees border the northern property line and shade loving plants like pawpaw and ostrich ferns are planted along the house's northern faces.
- ***East***- The east side of the site receives morning sun, which is less harsh and cooler than afternoon sun. This is a good location for tender partial shade and sun plants that don't do well with intense heat.
- ***South***- The south receives the most heat and light and is ideal for plants like vegetables that need maximum hours of sunlight to be the most productive. This is also the most favorable position to place a pond because even in the winter the sun is able to heat the water to some extent. Also, walls that face south are ideal for more tender fruit trees or plants that may not normally grow in colder climates. They absorb the heat form the sun and radiate it out creating a warmer micro climate that is acceptable for more tender plants.
- ***West***- Western exposures receive afternoon sunlight, which is more intense

than morning light. These locations are good for plants that like heat. Walls facing western sites, much like southern walls, heat up with the intense afternoon sun and create warmer micro climates for more tender plants like espalier fruit trees and grape vines.

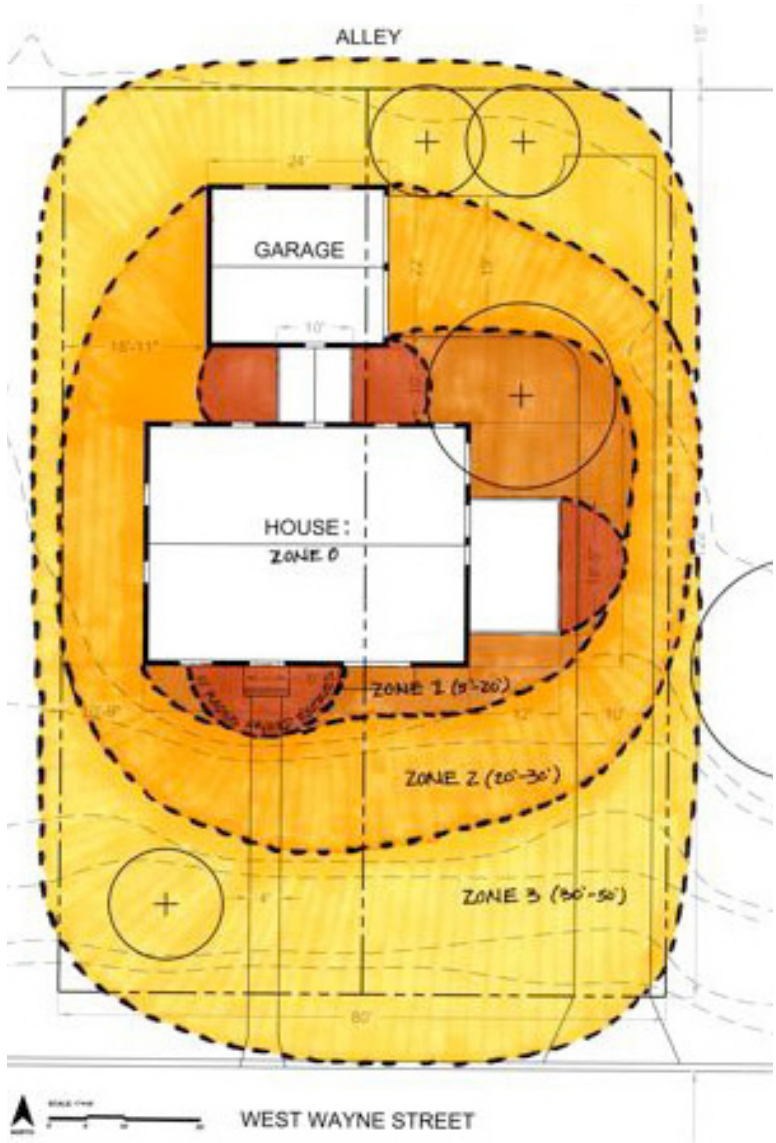
Water

Another element that should be examined when designing a home or any other site is water. When looking at this component it is important to keep in mind where the water is coming from, where it is going, and where we want it to go. On this particular site, water lands on the roof of the house, breezeway, and garage as well as the street, hardscape, and lawn area. The water that lands on the roofs can be taken and stored in rain barrels or cisterns to be used in the landscape later and the rain from the hard surfaces and street can be collected and filtered using a rain garden.

Zones, Entries, and Views

The garden should be an extension of the home, an outdoor living space that corresponds and fits with the indoor living spaces. An easy way to think about this is to divide a property into zones. Zones organize a space by looking at a plant species location in relation to the house and high traffic areas. For example, herbs are frequently used to cook with so it would make sense to locate these plants in close proximity to the kitchen door or window. Just as it doesn't make sense to locate your refrigerator in the bathroom, it does not make sense to put daily harvested vegetables in the back corner of the lot. Things that need daily attention will get the thought they need if placed upon paths that are part of your daily routine. Figure 3.2 shows the zone diagram for 1006 Wayne Street.

FIG 3.2: This is a zoning diagram for 1006 Wayne Street. The different zones have different meanings and uses.
ZONE 0: Usually always the home, the center of all the other zones.
ZONE 1: Zone 1 is the most visited zone. It is located around the main entrances and exits. Plants that need a lot fo care or can be frequently harvested are placed here because they are the most visited.
ZONE 2: Zone 2 on this site is located within 20 to 30 feet from the home and are places less visited than zone 1 but more than zone 3. Plants placed here need frequent care but are ok if they don't get it every day.
ZONE 3: Zone 3 is the farthest zone on the site but since the site is so small this zone is still pretty close to the building. Plants here would need to be only harvested once a year.
{Drawing: Vanessa Gilbert}



3.2 ZONE DIAGRAM

Zoning is really about convenience and should be present wherever possible. For example, in this project the compost was placed in the north corner of the chicken forage yard in the back of the property. This was done so that someone can walk straight out the back door and feed suitable kitchen scraps to the hens while on their way to the compost. The berry brambles planted along the west property line were placed there not only as a hedge but also, as a tool to connect to neighbors. While standing there picking berries it would be very easy to have a nice chat with friends and share the bounty of the harvest. When strolling up the front walk one could meander through the vegetable patch, plucking up weeds and collecting what has ripened that day. While watching the kids or friends playing on the lawn one could collect strawberries or water the beds from the front lawn cistern, catch a fish, or collect seeds and pollens from the nearby amaranthus and cattail. In the back, while eating a summer brunch, ripe tomatoes and herbs are within arms reach of the eating table. Convenience makes a site more functional and decreases the amount of work needed to keep it maintained. It also helps to connect the inside of the home to the outside. Views from the kitchen window allow one to keep an eye on the chickens while making meals and in turn, the chickens provide entertainment. The sweet smell of herbs wafts through the bedroom windows and the greenhouse door is two steps away from the kitchen. The front porch is just a continuation of the front entryway, a perfect example of how indoor spaces bleed out into the yard and how nature becomes welcomed into the home.

3.3
INTENSITY LEVELS (PRELIMINARY DESIGNS)

1006 Wayne Street was designed at three different levels. This was done to appeal to a larger variety of people and to show that residential edibility can happen at multiple intensity levels. Each level builds off of the previous, adding new elements, which increase the intricacy and productivity of the site. Level one is for those who would like to incorporate more plants but don't want to change the integrity of the built elements such as the existing house or hardscape. Level two keeps the same landscape elements but does minor changes to the hardscape and introduces chickens. Level three adds aquaculture and some minor structural changes to the garage and side patio.

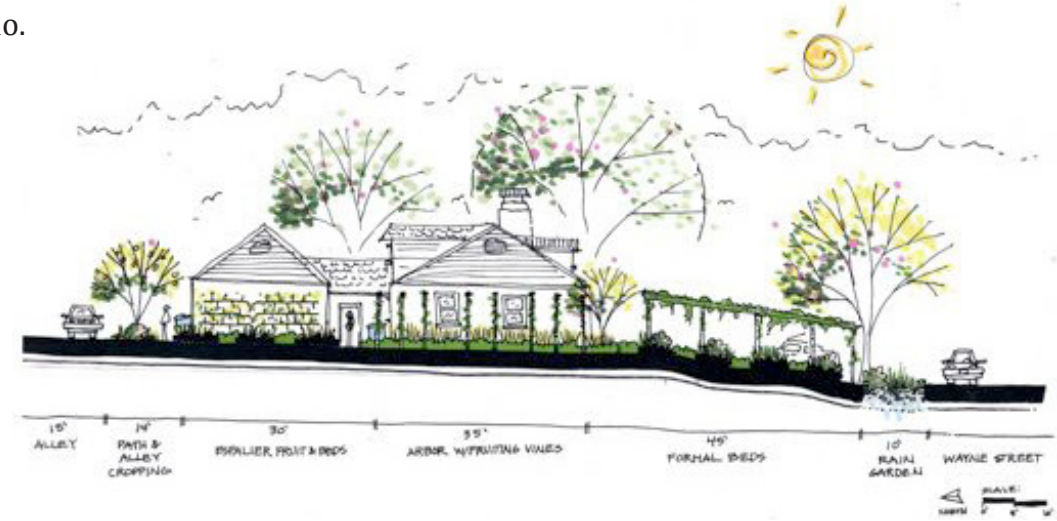


FIG 3.3: This section was taken from Level 1. It cuts through the west side of the property from north to south and shows the relationship of the rolling front lawn to the back. {Drawing: Vanessa Gilbert}

Level 1: Landscape Only

Level 1 does not alter the existing building or hardscape. Its design instead leaves existing built features as they are and focus on working with the soil and plant material to create an ecologically balanced ecosystem. It does not introduce any domesticated animals but focuses on providing habitat for native species. It also takes into account storm water and includes a rain garden to collect runoff from the street and rain cisterns to collect runoff from the roof, which stores the water so it can be used in the landscape.

GOALS:

- Create a healthy, balanced soil ecology
- Collect, store, filter storm water from roof and road on-site
- Provide small lawn space for activities
- Provide an outdoor gathering area
- Provide connection to existing alley
- Create habitat for wildlife
- Provide 20% of the produce needed for a family of 4
    - herbs, perennials, shrubs, vines, trees

SITE TOTALS:

- Building: 2,385 sq ft
- Lawn: 1,108 sq ft
- Bed Area: 4,319 sq ft
- Hardscape: 2,075 sq ft

FIG. 3.4: LEVEL ONE PLAN

Level 2: Landscape, Hardscape, and Minor Structural Changes

Level 2 makes minor changes to hardscape and the existing house structure. It reroutes the driveway so that it uses the alley instead of the street for access, which allows for more planting space. The side porch is converted into a greenhouse, chicken coop, and tool shed for yearlong productivity, housing for chickens, and storage. Lastly, a front entry and front patio were added as outdoor passive recreation spaces.

GOALS:

- Create a healthy, balanced soil ecology
- Collect, store, filter, and use storm water from roof and road on-site
- Provide small lawn space for activities
- Provide an outdoor gathering area
- Provide a connection to existing alley
- Create habitat for wildlife
- Provide 35% of the produce needed for a family of 4
    - herbs, perennials, shrubs, vines, trees
- Provide a greenhouse for year-round productivity
- Chickens and chicken coop
- Tool shed

SITE TOTALS:

- Building: 2,385 sq ft
- Lawn: 695 sq ft
- Bed Area: 4,804 sq ft
- Hardscape: 1,153 sq ft
- Greenhouse: 368 sq ft
- Chicken Coop/Tool Shed: 160 sq ft

FIG. 3.5: LEVEL TWO PLAN

Level 3: Landscape, Hardscape, and Structural Changes

The design for Level 3 moved the garage access from the east side to the north. This gave room for a chicken forage yard. An outdoor eating area was added to the west side of the garage. In the front an aquaculture pond was situated to the southeast and the front patio was converted into lawn space that looks out over the pond.

GOALS:

- o Create a healthy, balanced soil ecology
- o Collect, store, filter, and use storm water from roof and road on-site
- o Provide small lawn space for activities as well as, an outdoor gathering area
- o Provide a connection to existing alley
- o Create habitat for Indiana species
- Provide 50% of the produce needed for a family of 4
- o Chickens and chicken coop/ tool shed/ greenhouse
- Chicken forage yard
- Introduction of an aquaculture pond
- Back patio/eating area

SITE TOTALS:

- Building: 2,385 sq ft
- Lawn: 177 sq ft
- Bed Area: 5,065 sq ft
- Hardscape: 409 sq ft
- Greenhouse: 368 sq ft
- Chicken Coop/Tool Shed: 160 sq ft
- Chicken Forage Yard: 695 sq ft
- Aquaculture Pond: 661 sq ft

FIG. 3.6: LEVEL THREE PLAN

SECTION 4
{FINAL DESIGN}*

*After the preliminary designs, Level 3 was taken and designed with greater detail. It includes a careful look at ecosystems within the site, three main design components, and multiple design elements that come together to make 1006 Wayne Street a balanced, productive ecosystem.

4.1
ECOSYSTEMS

To make 1006 Wayne Street as productive, balanced, and diverse as possible five different ecosystems were created. These different ecosystems allow for a greater variety of plants can be grown which attracts a greater variety of animals and insects. This creates a stronger environment and healthier more productive plants. The five ecosystems within the site are:

Sun

This is the largest zone on the site and occupies the southern portion of the property. It includes 3 foot wide pathways that meander through it, allowing access to the many sun-loving, heat tolerant plants. Most of the plants located within this system are perennial and annual vegetables as well as brambles and low canopy trees like the serviceberry.

Shade/Orchard

The shade areas are to the north of the main building, where the house casts a shadow for most of the day. Shade loving plants and rain cisterns that collect rainwater runoff from the roof are located here. These areas are more moist and cooler than the rest of the property due to the shelter provided to them by the existing structures and existing sugar maple tree. The orchard row along the alley also is included in this ecosystem. The orchard trees provide dappled shade and a cooler, protected environment for the plants that grow beneath it.

FIG. 4.0: LEVEL THREE FINALIZED PLAN

Lawn/Forage Yard

The lawn area in front and the forage yard in the back are grassland habitats that are planted with alternative plants such as white clover and wild thyme. These plants are used instead of a typical grass yet still provide a green space that can withstand foot traffic and trimming. The forage yard also is planted with perennial wheat, buckwheat, and flax, which are sources of grain and provide food for the chickens.

Pond

The pond introduces water plants and water animals to the site. It has three different levels of plantings: marginal plants, deep-water plants, and floating plants. Marginal plants grow along the edge of the pond up to 1 foot deep and provide habitat for amphibians and other water loving animals. The deep-water plants grow in water deeper than 1 foot, but no more than 3 and provide food and hiding for fish. Floating plants provide shelter and food as well.

Rain Garden

The rain garden is located along Wayne Street and is a small wetland habitat that provides an area for food producing plants such as the blueberry that need bog like conditions to survive.

4.2
PLANTING DESIGN CONCEPTS

In order to produce half of the food needed to feed an average family of four certain measures have to be taken. Plants have to be placed in their proper locations, have the nutrients that they need, and space must be wisely used. The following are the three main planting design principles used to make this site as productive and balanced as possible.

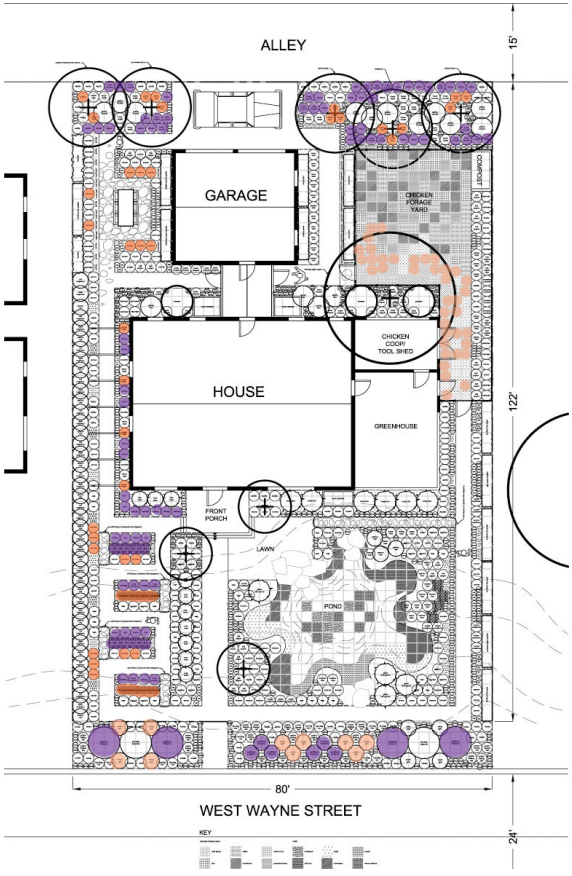
Companion Planting

Companion planting is grouping plants together and taking advantage of their natural needs and functions to benefit one another. There are many types of companions but the following four are categorized as: nursery plants, repellent plants, decoy plants, and attractant plants (Wallace 152).

- ***Nursery Plants***- nursery plants are plants that attract predators and parasites that will kill and feed off of the pests that damage crops.
- ***Repellent Plants***- repellent plants contain odors, poisons, or sharp appendages that deter plant pests away from crops. Examples of repellent plants would be mint, dead nettle, and anything in the allium family (garlic, onions).
- ***Decoy Plants***-decoy plants are plants that attract the harmful insects to themselves and when they are consumed poison or harm the pest in some way resulting in a reduced population or reproductive abilities. Yarrow is a good example of this.

- ***Attractant Plants***- attractant plants serve as a sacrifice. They attract plant pests to themselves so the crop goes unharmed but don't cause any harm to the troubler. A good example of this would be the eggplant and the potato. If planted in proximity to one another the potato beetle will eat the eggplant instead of the potato plants.

One companioning that was focused on heavily in this design was nitrogen fixers and nitrogen takers. This was done because low nitrogen levels is one of the main reasons people use inorganic fertilizers. But if people understood plant interactions they would realize that there are certain plants that produce nitrogen and if these plants are paired with plants that need a lot of nitrogen than they balance each other out and inorganic fertilizers become obsolete. Figure 4.5 shows a diagram of how these different plants were interspersed amongst each other to create a balanced system.



>FIG 4.1: This diagram shows how nitrogen fixers (orange) and heavy nitrogen users (purple) were planted together to create balance. {Drawing: Vanessa Gilbert}

FIG. 4.1: NITROGEN USAGE

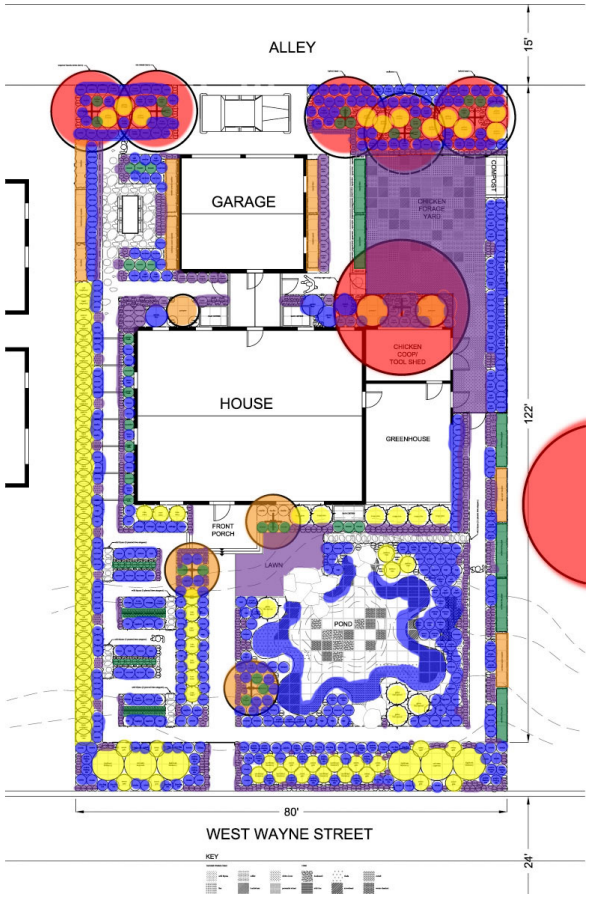


FIG. 4.2: LAYER USAGE

FIG 4.2: The design of 1006 Wayne Street utilized the seven layers of a forest. Each layer is represented in the diagram as a different color. Red: Canopy Layer, orange: lower canopy and bamboo layer, yellow: shrub layer, green: vine layer, blue: herbaceous layer, and purple: groundcover layer. {Drawing: Vanessa Gilbert}

Another type of companion is between plants and animals. Included in my site are chickens and an aquaculture pond. This was done not only for the food that these animals produce but also the relationships that they offer to the system they live in. Chickens help gardens immensely by eating pests that would harm crops. One example of this is the Japanese beetle. Japanese beetles are capable of devouring whole crops and can be very detrimental but if the plants that they harm are planted in a space that is accessible to chickens the chickens will eat the beetles and save the crop. Chickens are also good for gardens because their manure is very rich and can be used as fertilizer not only in planting beds but also in appropriate amounts to fertilize the pond. The fish are beneficial to the site in much the same way as chickens. They eat pests and bugs and help regulate water plant populations.

Alternative Plants

Alternative plants are edible plants that are native to the area but aren't usually commercially cultivated. They bring opportunities for more successful crops because they are in their natural habitats. They also provide diverse food choices that can be used as substitutions for more common foods. Examples of some alternative plants are provided below.

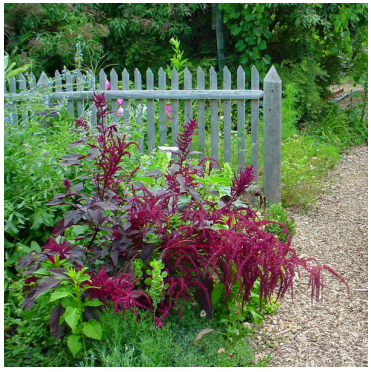


FIG 4.3, 4.4, 4.5: (left) Amaranthus is an annual plant that produces up to 5 pounds of edible seeds per year. (center) The pawpaw is a shade loving plant that produces 25 pounds of banana-like fruit each season. (right) The serviceberry or juneberry produces 10 pounds of berries in spring. {Photos: www.monchesfarm.com, www.foxislandalliance.org, www.homeorchardsociety.org}

Vertical Space

Utilizing vertical space is key for a site to reach its maximum productivity. It increases yields by increasing growing area without taking up bed space. Nature does this with vines and trees. Vines grow up the tree vertically without consuming horizontal space. Essentially it is growing two plants in the space of one. On this site vertical space was

utilized by incorporating vines, trees, and espalier trees. Also, trellises, arbors, and walls were added structural features to increase the site's vertical capacity.

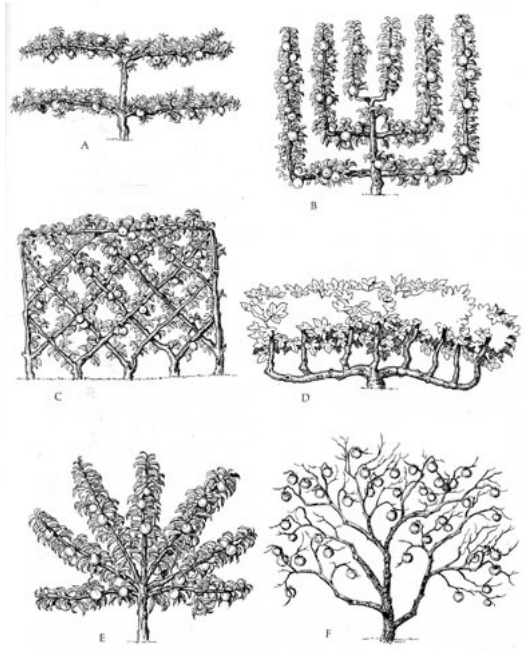


FIG 4.6, 4.7: (top) Without utilizing all the vertical space on site this design would not have produced enough food to provide for half of what an average family of four eats. One way vertical space was used was by specifying espalier fruit trees. This is a way of training a tree to grow flat against a wall or fence and comes in many different forms, the ones shown are: four-arm horizontal form, six-armed palmette verrier, a belgian fence, horizontal, fan-shaped, and informal (Creasy). It is very ornamental and though it causes the tree to have slightly smaller yields, the space that it saves is extremely beneficial. (bottom) Below is a photograph taken from a project designed by Hoerr Shaudt Landscape Architects who are based out of Chicago. This concept inspired the archways along the west side of the site which have brambles, roses, and vegetables growing up them to not only save space, but also to give a whimsical feel as one passes from the front yard to the back. {Sketch: *Complete Book of Edible Landscaping,* photo: www.hoerrshaudt.com}

4.3
DESIGN ELEMENTS

Paths and Beds

The site's paths and beds were the first components to be designed. They were made to maximize planting space and to help make crops more accessible, which would make harvesting easier. If crops cannot be reached, it decreases the productivity and functionality of the site. To solve the problems of accessibility and increase bed space planting beds were designed using a switchback design. These can be seen along the western side of the front yard. The idea for them was taken from the permaculture idea of a "key hole" bed. A key hole bed is illustrated in Figure 4.8 and is a way to organize plants around an access point. Frequently harvested plants are grown near the paths edge where it is easier to reach them and less frequently collected plants are planted farther away. The problem with this design is that it creates mini cul-de-sacs that lead to nowhere, disrupting the site's flow. Switchback beds solve this problem by allowing paths to continue through while still granting access to bed space without taking up too much space. The pathways wind and loop through the

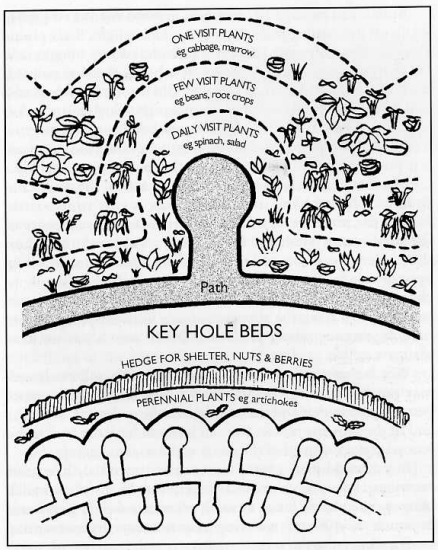


FIG 4.8: The above image shows an example of a key hole bed. This type of design maximizes accessibility while minimizing space taken up by a path but it results in dead ends that can interupt the flow of a garden. {Image: *Permaculture in a Nutshell*}

property and are 3 feet wide, the width needed to wheel a wheelbarrow through. Beds measure, in most cases, 6 feet wide, the width of two arm spans. This was done so that the average 3 foot arm could reach to the center of a bed from each side.

Water (Rain Cisterns and Rain Garden)

After beds and pathways were designed came the element of water. In order for many plants, like vegetables, to survive one must have water to give to them during dry, hot periods. Instead of using water that comes from the faucet or hose this site was designed to take water that lands on the roofs and store it in cisterns to be used in the landscape later. To determine how to incorporate rain cisterns into a design one must first figure out how much water can be collected on site. Figure 4.9 shows the equation used to determine how much water was to be collected and stored on site.

FIG 4.9:
ROOF COLLECTION CALCULATIONS

A= area of roof (roof footprint, do not include slopes)

R= rainfall in inches/year*

(A x R)/12= W cubic feet

W x 7.5= # of gallons of water roof collects/year

*this number could also be the number of inches of a typical storm event if trying to calculate on a smaller scale.

After calculations were made, three rain cisterns were located around the main house. The one situated in the front holds 1,065 gallons of water and the two in the back each hold 784 gallons of water. The total amount of storage is 2,633 gallons, approximately the amount of water produced by a typical two-inch storm event.

In addition to collecting water that falls on site, this design also takes into account water runoff from the street. Along the southern portion of the site a rain

garden was constructed to collect water from the street, temporarily hold it, and filter it by using plants and aggregate before it is absorbed fully into the soil. As seen in figure 4.10, the rain garden consists of curb cuts, which allows the water to flow from the street into the garden, a 6" depression to hold the water while it percolates through the aggregate layers and plant roots that filter the water before it is absorbed into the soil. This system is beneficial at many levels. It reduces the amount of water that flows into the combined sewer systems, brings more water to the site, and increases plant and animal diversity by providing a wetland habitat.

FIG. 4.10: RAIN GARDEN

FIG 4.10: The above drawing is a section cut through the rain garden that runs along the south property line. The curb is cut allowing water from the stree to flow into the garden and filter through the aggregate. {Image: *Permaculture in a Nutshell*}

Aquaculture Pond

The aquaculture pond is located in the front yard on the south side of the greenhouse. It covers 660 sq ft and reaches a depth of 4 feet. It was designed as a way to farm fish on site and is specifically engineered to raise tilapia. Tilapia was chosen because it tolerates a large range of environments and is very resistant to disease and parasites ("Raising Tilapia in Your Backyard."). In order to flourish they need water that is between ¾ of a meter to 1 meter deep or 2 ½ feet to about 3 ½ feet. The temperature needs to be 75 degrees Fahrenheit ("Raising Fish."). In Indiana the temperatures obviously get lower than 75 degrees so either a dome or small heater can be used to keep the water at the optimal temperature. To calculate the number of tilapia the pond can hold two things must be known:

- The surface area of water that is between 1 ½ to about 3 ½ feet
- That 2-3 tilapia can live in 1 sq meter

On this site the surface area of suitable water depth is 39 sq meters. This is multiplied by 2 fish, which equals 72, the number of fish that the pond can hold. And at .5 pounds each, it adds up to be approximately a yield of 36 pounds of fish per year.

The pond is designed for other plants and animals too, and tries to mimic a natural pond as much as possible. Its border is irregular shaped to increase the amount of edge, which increases water and land contact. This is important because in natural systems the edge is where the most life exists. Fish feed on the plants at the water's edge, birds nest, and other animals hide. So by creating more edge, more habitat is made. Along the edge there are also large rocks that jut out into the pond. This allows people to participate in the pond's activity and could serve as a fishing spot to catch tilapia.

The pond is naturally lined with powdered clay called bentonite, which can be

mixed with existing soil and spread to form a lining. This type of lining is good because if the clay cracks it will expand and heal itself (Fern 125). The one drawback is that if the water line lowers, it will leave the clay exposed to the sun, cracking it beyond repair. To solve this problem soil and rocks line the edge of the pond and shelter the clay beneath it from light and heat. Within the clay lining planting shelves were made. These house water plants at various depths according to their needs and provide places for young fish to hide.

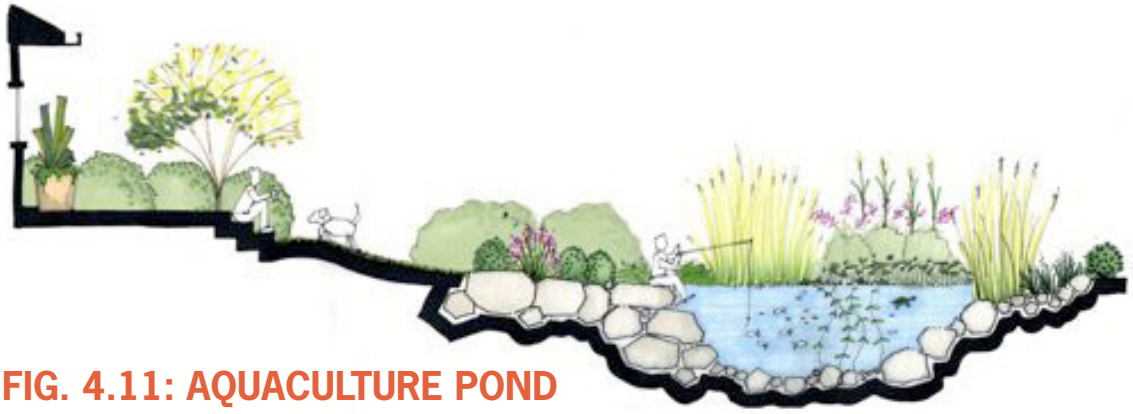


FIG. 4.11: AQUACULTURE POND

FIG 1.3: Above is a section cut through the aquaculture pond from north to south. It shows the connection of the lawn and front porch to the water's edge and also the interaction between humans and environment. {Drawing: Vanessa Gilbert}

The last benefit the pond has for the site relates to the greenhouse. Because the pond is located directly to the south of the greenhouse it helps to regulate its temperature and keeps it warm in the winter when sun angles are much lower. This happens because the winter sun's light and heat is reflected off of the water's surface and enters the greenhouse through its south face. This creates warmer winter temperatures within the conservatory.

Greenhouse/Chicken Coop

The greenhouse and chicken coop are located along the east face of the existing house, where the side porch previously sat. This was done to give the front face of the greenhouse the most exposure to southern sunlight. It was also done because the greenhouse can utilize an existing door that opens directly to the dinning room and kitchen. This allows for direct access from food plants grown in the conservatory to the table where they will be eaten. It is also a convenient location because there is space for the chicken coop and tool shed to be located right behind it. When this is done the heat produced by the animals radiates through the shared wall and helps keep the greenhouse warm while the heat from the greenhouse radiates into the chicken coop keeping the animals warm.

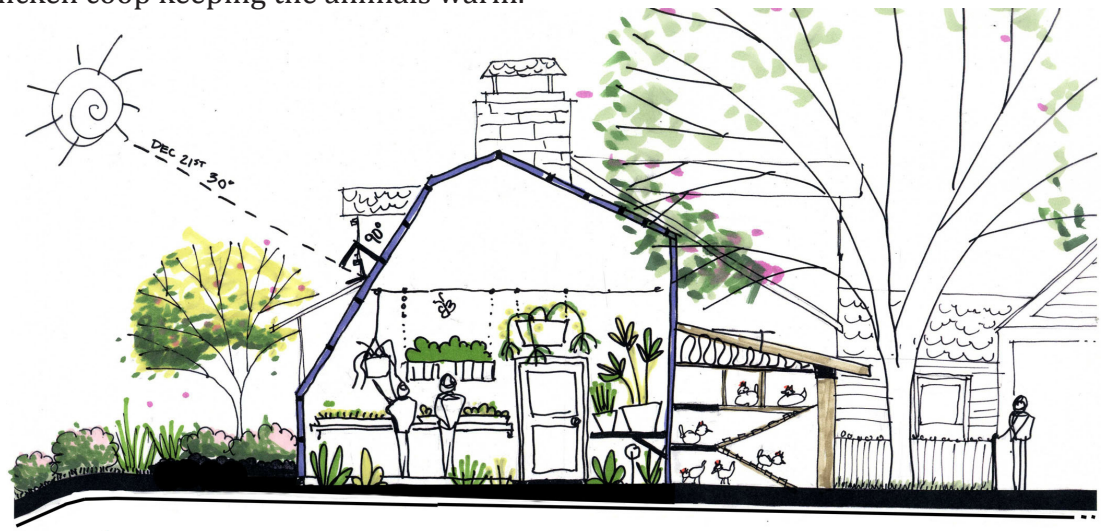


FIG. 4.12: GREENHOUSE AND CHICKEN COOP

FIG 4.12: Above is a quick sketch that illustrates the combination of the chicken coop and greenhouse and how the they are connected to share heat. {Drawing: Vanessa Gilbert}

Chicken Forage Yard

The chicken forage yard is located in the back yard where the driveway used to be. It consists of a fence that encloses a 695 sq ft yard that is planted with flax, wild thyme, white clover, chicory, pearl millet, buckwheat, and perennial wheat. These plants are interspersed amongst each other creating a patchwork quilt effect of plant textures and colors. These plants serve as forage for the chickens and provide the site with another interesting ecosystem.

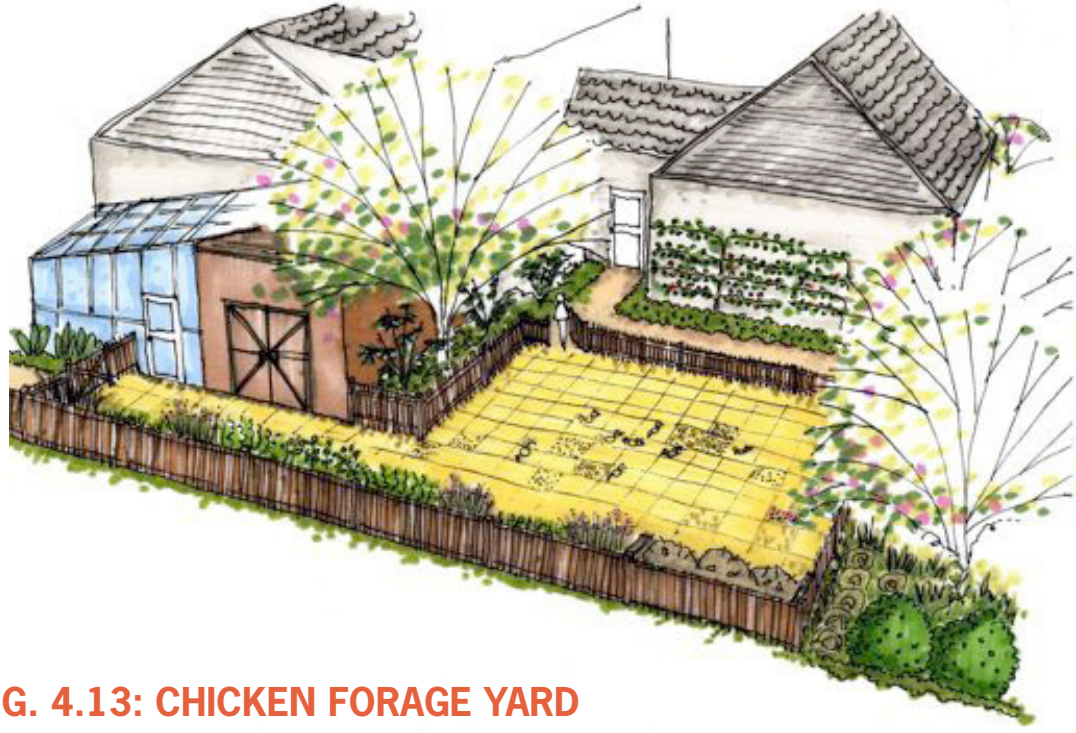


FIG. 4.13: CHICKEN FORAGE YARD

FIG 4.13: A fenced forage yard is situated around the chicken coop so that the chickens have direct access and are able to roam free without hindering planting beds. {Drawing: Vanessa Gilbert}

Outdoor Eating Area

The outdoor eating area was designed in the intimate space west of the garage. It is a private space that is screened by espalier pear and peach trees as well as trellised tomato vines. It sits in a sunny location and has direct access to the kitchen's back door. It consists of flagstone paving inter planted with wild thyme and a set of table and chairs for relaxing, and entertaining. This space allows "dining out" to be a matter of stepping out the back door.

FIG. 4.14: OUTDOOR EATING AREA

FIG 4.14: This view is looking east into the outdoor eating area. The space is screened by espalier fruit trees, bamboo, and tomato trellises. {Drawing: Vanessa Gilbert and Benjamin Hanus}

4.4
CONNECTION TO NEIGHBORS AND COMMUNITY

While designing this project one question kept coming up:

How does this site and design relate to the neighborhood and community?

This is a very good question, and a very important one, but just because this design doesn't include a sidewalk from it's door to the neighbor's or a "community garden" does not mean that it is void of community and human interaction. The whole concept of residential edibility is based on relationships. Relationships between plants, relationships between animals, and relationships between humans. When a yard is converted from grass to an ecosystem it automatically opens itself up to the community. It does this because it catches people's attention, it makes them want to stop and look, see what plants you have used. This creates communication and the sharing of knowledge and later, relationships. The connection to the neighborhood and community is not an arrow on a site plan but a connection between people's heart, souls, and stomachs.

4.5
CONCLUSION AND FINAL RESULTS

Humans have disconnected themselves from nature and no longer realize the connection between themselves and the environment. This disconnection has lead to the destruction of the vital ecosystems that people are so dependent on for survival. This project has reconnect people to nature through the production and consumption of food. It has informed people that food has the ability to impact their lives, either positively or negatively, and that they have the power to control which of the two it shall be. This will empower them to do their part in making their environment a healthier place to live. As food visionary Alice Waters said,

> "People are transformed in the process of growing, gathering, preparing, and offering food. Everybody has to do it three times a day, and if you can do it in a way that teaches important values, it can be transformational. It can change you and it can change the world around you" (Walljasper 295).

This project provides people with a guide on how they can contribute to the healing of our environment by reducing their impact on the earth by producing their own food on their own properties. It used the principles of permaculture, forest gardening, and paradise gardening as its foundation and base, mimicking nature to replicate the systems and relationships within it so that these relationships and connections create a thriving productive ecosystem. But did this project succeed? Did it produce half the food needed to feed an average family of four? (turn to find out!) >

THIS SITE PRODUCED...

1,182 pounds of vegetables

1,460 pounds of fruit

45 pounds of nuts

36 pounds of grain

860 pounds of eggs

36 pounds of fish

..... 3,618 POUNDS OF FOOD!

FIG. 4.15: FRONT YARD VIEW OF FINAL REDESIGN

FIG 4.15: This view is looking east into the outdoor eating area. The space is screened by espalier fruit trees, bamboo, and tomato trellises. {Drawing: Vanessa Gilbert}

SECTION 5
{APPENDIX}

5.1
LIST OF FIGURES

5.2
GLOSSARY

Attractant Plants serve as a sacrifice. They attract plant pests to themselves so the crop goes unharmed but don't cause any harm to the troubler. A good example of this would be the eggplant and the potato. If planted in proximity to one another the potato beetle will eat the eggplant instead of the potato plants.

Decoy Plants are plants that attract the harmful insects to themselves and when they are consumed poison or harm the pest in some way resulting in a reduced population or reproductive abilities. Yarrow is a good example of this.

Ecosystems are complex networks of organisms that interact together to form strong, healthy, and balanced environments.

Forest Gardens are a type of ecological design that is used for the production of food and other resources that are usable by humans. It consists of perennials, shrubs, and trees and mimics the natural cycles found within forest ecosystems.

Homegrown is a means of growing food on the same property as the home of the people who eat it.

Paradise Gardens are a type of ecological design that strives to increase the diversity and health of the environment. It is an environmentally conscience landscape that

promotes an environmentally conscience lifestyle of low impact living by using minimal resources.

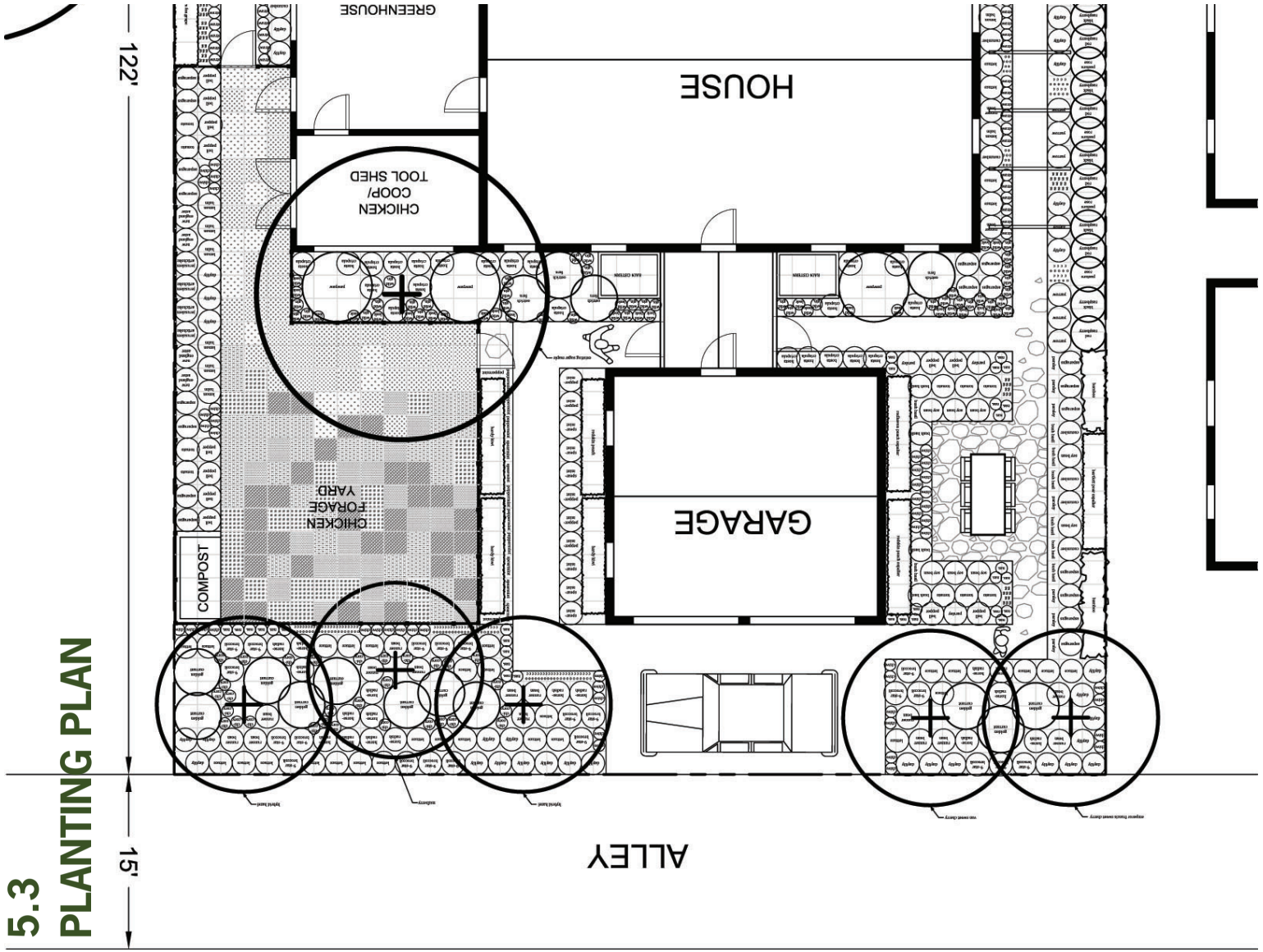
Permaculture is a type of ecological design that takes into account all parts of an ecosystem and mimics natural environmental systems found in nature to create a successful productive environment.

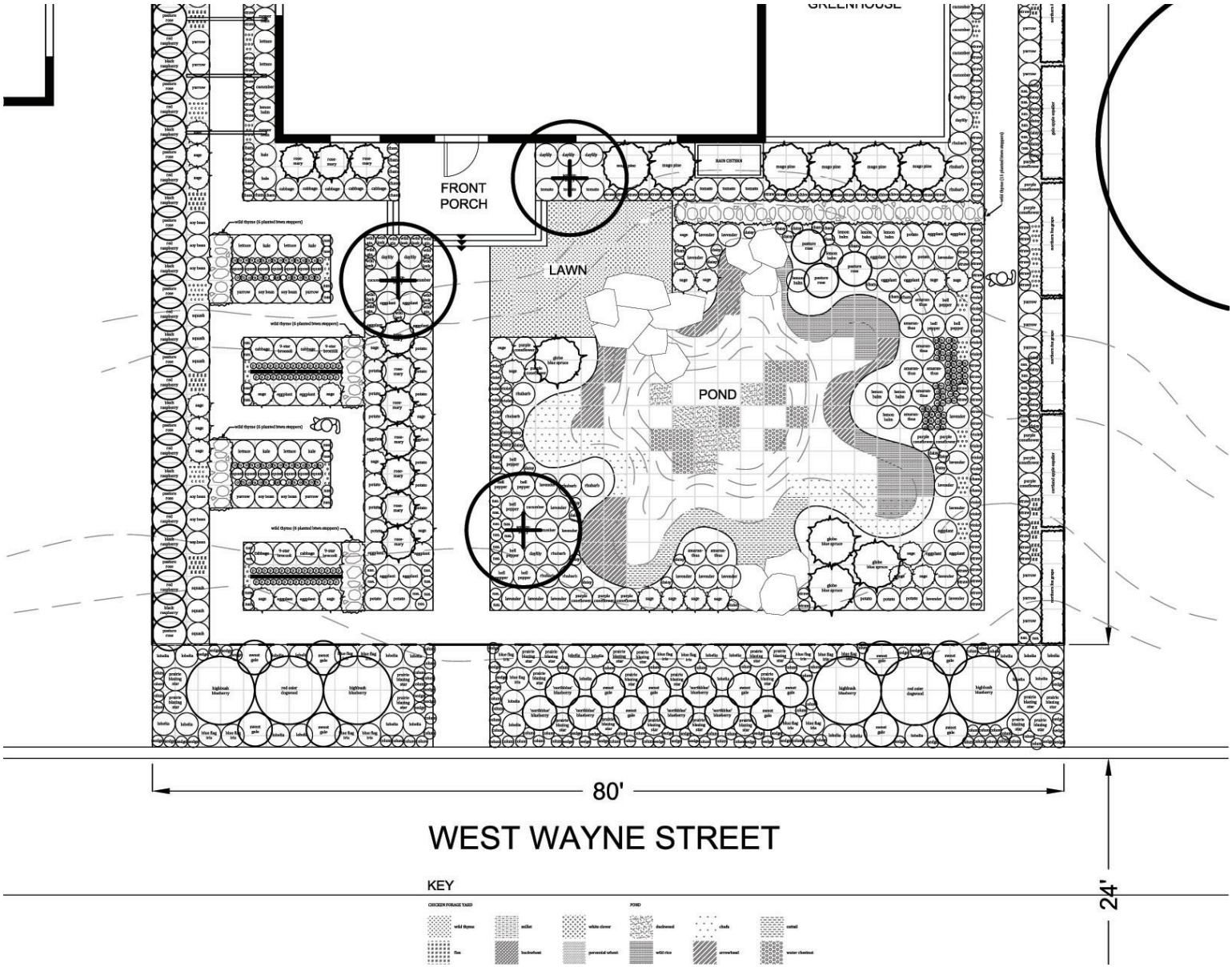
Repellent Plants contain odors, poisons, or sharp apendages that deter plant pests away from crops. Examples of repellent plants would be mint, dead nettle, and anything in the allium family (garlic, onions).

Urban Ecology is the system of organisms that interact within manmade environments.

Nursery Plants are plants that attract predators and parasites that will kill and feed off of the pests that damage crops.

5.3 PLANTING PLAN




GREENHOUSE
FRONT PORCH
RAIN CISTERN
LAWN
POND
80'
WEST WAYNE STREET
24'
KEY
CHICKEN FORAGE YARD
POND

5.3
PLANT LIST

PLANT	LIGHT	HT.	W.	PRODUCT	HARVEST/BLOOM TIME	YIELD
Canopy Layer						
Corylus x hybrids Hybrid hazel		12-20'	12-25'	nut	J F M A M J **J A S O** N D	10-35 lbs
Morus nigra 'Geraldi Dwarf' Mulberry		30'	30'	fruit	J F M A M J **J A** S O N D	5-25 lbs
Prunus avium 'Emperor Francis' Emperor Francis Sweet Cherry (semid)		6-8'	8-15'	fruit	J F M A M **J J** A S O N D	50 lbs
Prunus avium 'Van' Van Sweet Cherry (semidwarf)		6-8'	8-15'	fruit	J F M A M **J J** A S O N D	50 lbs
Low Tree Layer (Ornamentals and Bamboo)						
Amelanchier canadensis Juneberry, Serviceberry		20'	10'	fruit	J F M A M **J J** A S O N D	10 lbs
Arundinaria gigantea spp. tecta Small Cane Bamboo		6'	indef.	shoots	J F M A **M** J J A S O N D	unknown
Asimina triboba Pawpaw	⋮	10-25'	15-25'	fruit	J F M A M J J **A S O** N D	25 lbs
Malus cortland Cortland Apple (semidwarf espalier)		12'	20'	fruit	J F M A M J J A **S** O N D	48 lbs
Malus pumila 'Gala' Gala Apple (semidwarf espalier)		12'	20'	fruit	J F M A M J J **A S** O N D	48 lbs
Prunus persica 'Redhaven' Redhaven Peach (semidwarf espalier)		10-14'	10-14'	fruit	J F M A M J **J A** S O N D	100 lbs
Prunus persica 'Redskin' Redskin Peach (semidwarf espalier)		10-14'	10-14'	fruit	J F M A M J **J A** S O N D	100 lbs
Pyrus communis Bartlett Pear (espalier)		espalier		fruit	J F M A M J J **A S** O N D	56 lbs
Shrub Layer						
Picea Pungens 'Globosa' (E) Globe Blue Spruce		3-5'	3-6'		**J F M A M J J A S O N D**	
Pinus mugo (E) Mugo Pine		3'	5'		**J F M A M J J A S O N D**	
Ribes aureum Golden Currant	⋮	3-8'	3-6'	fruit	J F M A M J **J A S** O N D	3-10 lbs
Rosa Carolina Pasture Rose		3'	3'	rose hips, petals	J F M A M J **J A S O** N D	4 lbs
Rubus idaeus var. strigosus American Raspberry		4-6'	4-6'	fruit	J F M A M J **J A** S O N D	1.5 lbs
Rubus occidentalis Black Raspberry		3-6'	3-6'	fruit	J F M A M J **J** A S O N D	2-3 lbs

# PLANTED	TOTAL YIELD (LBS)	NOTES	COMPANIONS
2	45.0		
1	15.0		
1	50.0		
1	50.0		not good with potato or wheat.likes clover and alfalfa
TOTAL LBS:	160.0		
3	30.0	likes north slopes	
8 sq.ft	n/a	needs frost protection, dappled shade	
3	75.0	2 yrs. to fruit	
1	48.0	1-6 bushels	
1	48.0	1-6 bushels	
2	200.0	can form fan espalier	
2	200.0	can form fan espalier	
1	56.0		
TOTAL LBS:	705.0		
4	n/a	rounded growth	strawberry
6	n/a	very tolerant	strawberry
11	110.0	3 yrs. to fruit, attracts hummingbirds, flwrs May	
14	56.0	most common rose in Indiana, hips high in vit. c	raspberries, blackberries
14	21.0	biennial	garlic, does not like:peppers, eggplant, tomato, potato, straw spread of *verticillium* which is a fungi that harms raspberries
14	42.0		
TOTAL LBS:	229.0		

PLANT	LIGHT	HT.	W.	PRODUCT	HARVEST/BLOOM TIME	YIELD
Herbaceous Layer (Herbs, Perennials, and Grasses)						
PERENNIAL HERBS						
Allium sativum Garlic		1-3'	1-2'	cloves	J F M A **M J J A S O** N D	.02-.1 lbs
Allium schoenoprasum Chives		6-20"	6-20"	leaves	J F M A **M J J A S O** N D	
Allium tricoccum Wild Leek, Ramps		1'	1'	bulb, leaves	J F M **A M** J J A S O N D	.095-.38 lbs
Asarum canadense Wild Ginger		2"	8"	root	J F M A M **J J A S** O N D	unknown
Chamaemelum nobile Chamomile		3-6"	1'	young sprigs	J F M A **M J J A S O** N D	
Echinacea purpurea Purple Coneflower		3'	1-2'	roots for herbal tea	J F M A M J J A **S O** N D	
Lavandula angustifolia Lavender		2-3'	2-3'	flowers	J F M A **M J J A S O** N D	
Melissa officinalis Lemon Balm		14-24"	2'	leaves	J F M A **M J J A S O** N D	
Mentha spicata (E) Spearmint		8-24"	indef.	leaves	J F M A **M J J A S O** N D	
Mentha x piperita (E) Peppermint		1-2'	indef.	leaves	J F M A **M J J A S O** N D	
Rosmarinus officinalis (E) Rosemary		3-4'	3-4'	leaves	J F M A **M J J A S O** N D	
Salvia officinalis (E) Broadleaf Sage		2'	1-2'	leaves	J F M A **M J J A S O** N D	
Thymus serphyllum (E) Wild Thyme				leaves	J F M **A M J J A S O** N D	unknown

# PLANTED	TOTAL YIELD (LBS)	NOTES	COMPANIONS
170	10.2	disease repellent and insecticide	raspberries, roses (helps prevent greenfly), potatoes, tomat lettuce, strawberries. does not like peas and beans
55		disease preventative	roses (prevent black spot),gooseberries, cucumbers, apples carrots, no beans and peas
33	15.7		onions and carrots (keeps carrots flies away), lettuce
45			
31		aids absorption of calcium	cabbage, onions, wheat(1/100)
12		harvest only 2-4 yr. old roots, attracts butterflies	
17			
17		light shade	
16		insect repellent	cabbage, tomatoes, radishes, roses (deter aphids)
16		insect repellent	cabbage, tomatoes, radishes, roses (deter aphids)
10			cabbage, bean, carrot, sage
28		insect repellent	cabbage (deters white butterflies), carrot, rosemary
162 sq.ft		antibacterial	cabbage

PLANT	LIGHT	HT.	W.	PRODUCT	HARVEST/BLOOM TIME	YIELD
PERENNIAL VEGETABLES						
Allium cepa 'Perutile' (E) Everlasting Onion		2'	1'	bulb	**J F M A M J J A S O N D**	.04-.2 lbs
Armoracia rusticana Horseradish		18-30"	18-30"	root	J F M A M **J J A** S O N D	unknown
Asparagus officinalis Asparagus		3-5'	18-36"	shoots	J F M A **M** J J A S O N D	1.5 lbs
Brassica oleracea Wild Cabbage		3'	2'	leaves	J F M **A M** J J A S O N D	1.1-4.5 lbs
Brassica oleracea acephala 'Daubenton' Perennial Kale		3-9'	3-5'	leaves	J F M A **M J J A** S O N D	.9-1.8 lbs
Brassica oleracea botrytis aparagoides Nine-star Perennial Broccoli		18-36"	1-2'	flower buds	J F M A M **J J A** S O N D	.3-.6 lbs
Fragaria vesca 'Semperflorens' (E) Alpine Strawberry	⋮	10"	10"	fruit	J F M A M **J J A** S O N D	.2 lbs
Helianthus tuberosus Jerusalem Artichokes		6-12'	4-9'	tubers	J F M A M J J A **S O** N D	1.2-5 lbs
Lactuca perennis Perennial Lettuce	⋮	2'	1'	leaves	J F M A **M J J A** S O N D	.4-1.7 lbs
Lactuca x cultorum Rhubarb		3-5'	3-5'	stalks	J F M A M **J J A** S O N D	unknown
ANNUAL VEGETABLES						
Cucumis sativus Cucumber	⋮			fruit	J F M A M J **J A S** O N D	1.0-3.6 lbs
Cucurbita spp. Squash				fruit	J F M A M J **J A S O** N D	5.6-13.6 lbs
Capsicum annuum Bell Pepper				fruit	J F M A M J **J A S O** N D	.2-.8 lbs
Daucus carota var. sativus Common Carrot				root	J F M A M J J **A S O N D**	.016-.2 lbs
Glycine max Soybean				seed	J F M A M J J A **S O** N D	.01-.02 lbs
Lycopersicon lycopersicum *Tomato*				fruit	J F M A M J **J A S O** N D	2-16 lbs
Pisum sativum Garden Pea				seed	J F M A M J **J A S** O N D	.02-.08 lbs
Solanum melongena Eggplant				fruit	J F M A M J J **A S** O N D	1.0-3.0
Solanum tuberosum Potato				tuber	J F M A M J J A **S O** N D	.4-3.1
Zea mays Corn				seed	J F M A M J J **A S** O N D	.3-1.3 lbs

# PLANTED	TOTAL YIELD (LBS)	NOTES	COMPANIONS
240	48.0	! leaves poisonous to dogs	parsely keeps onion fly away
17		wild animals don't like smell	orchard trees (anti root rot), potato, tomato
19	28.5	! berries are poisonous	tomatoes, parsely, basil
9	40.5		thyme, chamomile, dill, garlic, onions, peppermint, rosemary celery, potato, fava beans, beets
6	10.8		corn, peas
25	15.0		rosemary, thyme, sage, onion, garlic, beets
106	21.2		bush beans, lettuce, pine/spruce needles, onions, soybeans. cabbage
4	20.0	!can be invasive, likes damp place	
38	64.6		cucumbers, onions, radish, carrot, dill and chervil (protects a
12		harvest 2nd year, remove tall seedpods	
TOTAL LBS:	274.5		
15	54.0	likes shade	corn, beans, peas,young orchards, sunflowers, no aromatic h
20	272.0	needs N_2	radish, nasturtiums
22	17.6	nice ornamental	tomato, parsley, basil,carrot, onion. no apricot trees
110	22.0	needs lime,humus, and potash	strong-smelling to ward off carrot fly: leeks, onions, beans, l radishes, tomatoes, no dill
18	0.4	nitrogen fixer	good with everything
16	256.0	!leaves and stems poisonous	asparagus, basil, parsley, alliums, nasturtium but no, cabbag
62	5.0	nitrogen fixers	beans, carrots, corn, cucumbers, radish, aromatic herbs, no
22	66.0	act as trap for potato beetle	thyme, beans, potato (will deter Colorado Potato Beetle)
23	71.3		horseradish, corn, cabbage, beans, eggplant but does not lik pumpkin, raspberry, squash, sunflower, tomato
124	161.2	needs nitrogen	cucumber, squash, kale, cabbage,broccoli, cabbage, beans, p sunflowers, no tomatoes
TOTAL LBS:	925.4		

PLANT	LIGHT	HT.	W.	PRODUCT	HARVEST/BLOOM TIME	YIELD
PERENNIAL COMPANIONS						
Achillea millefolium Yarrow	⋮	8-36"	indef.	leaves	J F M A M J **J A** S O N D	
Aquileqia canadensis Columbine		1-2'	1-2'	flower	J F M **A M J** J A S O N D	
Aster novae-angliae New England Aster		2-6'	2'		J F M A M J **J A S** O N D	
Bellis perennis English Daisy		6"	1-2'		J F M A **M J J A** S O N D	
Cichorium intybus Chicory	⋮	1-4'	1-2'	leaves	J F M A **M J J A S** O N D	
Hemerocallis fulva *Daylily*		2'	2'	young shoots, flwr	J F M A M **J J A** S O N D	
Hosta crispula Hosta	⋮	1-2'	3'	petioles (leaf stems)	J F M A **M J J A S** O N D	
Matteuccia struthipteris Osterich Fern		2-3'	5'	frons	J F M A **M J J A S** O N D	
Tropaeolum polyphyllum Nasturtium		2-3"	12"	seed pods, flwrs, leaves	J F M A **M J J A S** O N D	
Viola odorata Sweet Violet		3"	6"	petals	J **F M A M** J J A S O N D	
ANNUAL COMPANIONS						
Amaranthus caudatus Love Lies Bleeding		3-6'	2'	leaves, seeds	J F M A M **J J A** S O N D	1.3-5.1 lbs
Vine layer						
Actinidia deliciosa Kiwi Fruit		20-100'		fruit	J F M A M J J A **S O** N D	50-200 lbs
Phaseolus coccineus Runner Beans		1-3'	1-3'	seeds	J F M A M J **J A S** O N D	.048-.171 lbs
Vitis labrusca Northern Fox Grape		35'+		fruit	J F M A M J J **A S O** N D	10-30 lbs
Forage Yard Plants						
Linum ustatissimum Flax				seed	J F M A M **J J** A S O N D	unknown
Trifolium repens White Clover		4-10"	4-10"	leaves, flower	J F M **A M J J A S O** N D	unknown
Pennisetum glaucum Pearl Millet				grain	J F M A M J J A **S O** N D	.055 lbs/sq.ft
Fagopyrum esculentum Common Buckwheat				grain	J F M A M J J A **S O** N D	.003 lbs/sq.ft
Triticum x aestivum Perennial Wheat				grain	J F M A M **J J** A S O N D	.04 lbs/sq.ft

# PLANTED	TOTAL YIELD (LBS)	NOTES	COMPANIONS
22		!eat in moderation, don't eat if pregnant. repellent, decoy	corn, grapes, roses
64			
4		bloom august to october	
34			
30		long tap root, good for intercropping	
34			
20		susceptible to slugs	
4			
78		insect repellent	squash, cucumbers, potatoes, tomatoes
20			
9	30.6	nutrient pump, deep root	corn, eggplant, onions, peppers, no toms
2	300.0	south and west walls best	
18	3.1	must be thoroughly cooked before eaten	
4	80.0		blackberries, sage, but does not like cabbage
TOTAL LBS:	413.7		
50 sq.ft		breaks up lumpy crusty soil	potato, carrots
89 sq.ft		nitrogen fixer	
54 sq.ft	3.0		
66 sq.ft	0.2		
54 sq.ft	2.2		
TOTAL LBS:	5.3		

PLANT	LIGHT	HT.	W.	PRODUCT	HARVEST/BLOOM TIME	YIELD
Pond Plants						
Trapa natans Floating Water Chestnut				seed	J F M A M J **J A S** O N D	
Typha latifolia Common Cattail				shoots, pollen, roots	J F M **A M J J A** S O N D	
Wolffia arrhiza Least duckweed				leaves	J F M **A M J J A** S O N D	
Zizania aquatica var. aquatica Wild Rice				grain	J F M A M J J A S O N D	
Sagittaria latifolia Arrowhead		1-3'		tubers, buds,fruit	J F M A M J J **A S O** N D	
Cyperus esculentus Chufa		1-3'	1'	tubers	J F M **A M** J J A S **O** N D	
Rain Garden Plants						
Carex muskingumensis Palm Sedge		2-3'	2-3'		J F M A **M J J A S** O N D	
Cornus sericea (shrub) Redosier Dogwood		6'	6'		**J F M A M J J A S O N D**	
Iris versicolor Blueflag Iris		1-2.5'	2'		J F M A **M J** J A S O N D	
Liatris pycnostachya Prairie Blazing Star		2-5'	2'		J F M A M **J J A S** O N D	
Lobelia cardinalis Cardinal Flower		3'	2-3'		J F M A M J J **A S** O N D	
Myrica gale (shrub) Bog Myrtle, Sweet Gale		2-6'	2-6'		J F **M A M** J J A S O N D	
Vaccinium 'Northblue' (shrub) Northblue Blueberry		18-24"	24"	fruit	J F M A M **J J** A S O N D	5 lbs
Vaccinium corymbosum (shrub) Highbush Blueberry		6-12'	6-12'	fruit	J F M A M **J J** A S O N D	7 lbs
						SITE YIE

# PLANTED	TOTAL YIELD (LBS)	NOTES	COMPANIONS
10		floating water plant	
10		shoots collected when less than a foot and a half	swampy areas, ponds, marshes
7		floating water plant	
17			
18		grows best in 1-2' deep water	
20		grows best in marginal water	
42		foliage plant	
2		does well in moist conditions, red branches	
15			
22		purple flowers in summer and fall	
30		red flowers from early august to september	
6			
6	30.0	showy fall foliage	
4	28.0		grows well with heathers and is acid loving
TOTAL LBS:	58.0		
VEGGIES	1,181.8		
FRUIT	1,460.2		
NUT	45.0		
GRAIN	35.9		
ELD/YEAR:	2,722.9		

5.5
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